भारतीय मानक
Indian Standard

IS 4772 : 2019

चीनी गोदामों के निर्माण के लिए अभ्यास का कोड

(दूसरा पुनरीक्षण)

Code of Practice for Construction of Sugar Godowns

(Second Revision)

ICS 67.180.10

भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
मानक भवन, 9 बहादुरशाह ज़फर मार्ग, नई दिल्ली – 110002
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI-110002
www.bis.gov.in www.standardsbis.in

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Sugar Industry Sectional Committee, FAD 02

FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Sugar Industry Sectional Committee had been approved by the Food and Agriculture Division Council.

This standard was first published in 1968 with a view to providing details of the construction of godowns in which humidity inside is not affected by the alteration in the humidity of the outside atmosphere and subsequently revised in 1983.

The first revision of this standard was undertaken to modify the requirements in the light of comments received from various construction agencies and organizations implementing the standard a number of changes have been made such as:

a) Improved damp-proofing treatment,
b) Modification of filling of the plinth and floor,
c) Method of making the godown resistant to earthquake forces,
d) Adoption of anti-termite measures, and
e) Other requirement which would make the godown structurally stable have been added.

The second revision of this standard has been carried out to incorporate the following changes:

a) Improved construction techniques and materials used for speedy and economical construction for example, cement concrete/reinforced cement concrete (RCC) flooring recommended using vacuum dewatering system and pre-engineering shed's roofing systems using light weight Z-purlins, portal frame for roof instead of trusses (to have more storage height and volume economy) have been included. Similarly instead of conventional Asbestos Corrugated sheet (ACS) or Corrugated Galvanised Iron (CGI) sheets, sheets of trapezoidal section of longer lengths of polymer coated sheets and galvnaized sheets have been prescribed;
b) Use of brick flooring may be avoided as far as possible;
c) Installation of water hydrants outside the periphery of godown;
d) Capacity and dimensions of sugar godowns revised from 100 kg per bag to 50 kg per bag of sugar with proportionate volume modifications. Accordingly stack height, capacities and dimensions of sugar godowns based upon 100 kg bags is revised to 50 kg bags reflected in modified Table;
e) Constructional details of road side platform are incorporated; and
f) Provision of ventilators has been removed.

It has been found that 1.5 to 2.0 percent of the total sugar bags of plantation white and refined sugar stored in godowns get damaged to varying degrees depending upon the nature and design of godowns, the manner of storage, etc. In addition, entire sugar stored in godowns undergoes deterioration to varying extent depending on the quality of sugar, the conditions of construction of godowns and the conditions prevailing in the sugar godown.

There are three primary causes of deterioration, namely, humidity, temperature and micro-organisms. Of these, moisture is the most significant cause for the spoilage of sugar in godowns and it also controls the effect of micro-organisms and temperature. Sugar is hygroscopic in nature and absorbs moisture when the relative humidity of the atmosphere is high. When the moisture content of sugar increases; it becomes syrupy and sticky on its surface. Moist sugar is more susceptible to deleterious effects of microorganisms and temperature; its hygroscopicity increases and greater deterioration takes place. An essential condition for preventing deterioration of sugar is, therefore, to maintain low humidity (not more than 60 percent relative humidity) in the godowns. For this purpose, it is essential to so construct the godowns as to arrest the ingress of moisture and enable the humidity inside the godown to be controlled. The entry of moisture into the godown could be from:

a) Outside atmosphere, or
b) Subsoil water.

(*Continued on third cover*)

Indian Standard

CODE OF PRACTICE FOR CONSTRUCTION OF SUGAR GODOWNS

(Second Revision)

1 SCOPE

This Indian Standard covers the requirements and the methods of construction of godowns for storage of bagged sugar.

2 REFERENCES

The standards listed in Annex A contain provisions, which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated at Annex A.

3 REQUIREMENTS

The basic requirements for storage of sugar in godown without deterioration is to minimize the ingress of moisture from all sides using environment friendly materials of largest size, modern speedy construction and material handling techniques.

4 LOCATION

4.1 The godown shall be constructed on raised, well-drained ground, the level of which is higher than the ground level. Even in the extreme circumstances of heavy rain, water shall not stagnate near the godown or enter the godown through its openings.

4.2 The godown shall be located far away from spray ponds, cooling towers and in such a way that the prevailing wind direction does not carry the spray of moisture laden air to the godown. Other sources of moisture, such as exhaust blow off, boiler blow downs, condenser water channels, and storm water drains should be led in the direction away from the godowns.

4.3 The godowns shall, as far as possible, be adjacent to the bagging house in a sugar factory. This facilitates the transport of bags to the godown.

4.4 In selecting the location, maximum attention should be paid to the hygienic and sanitary conditions of the area and the construction in residential areas shall be avoided, as far as possible. The following minimum distances shall be maintained.

a) Bone crushing mills, garbage dumping grounds, slaughter houses, tanneries and hide curing centres, sewage treatment plants, or such other places, the vicinity of which is deleterious to the safe storage of non-perishable agricultural commodities	500 m
b) Kilns, Dairies (processing units) and poultry runs	300 m
c) Factories and other sources of fire and environmental hazard such as workshops, hay stacks, timber stores, petrol pumps, CNG stations and LPG bottling plants.	150 m

4.5 The structure should be free from passing over of any high tension electric line and in the event of such lines passing over, then the relevant electrical code provisions should be taken into account while planning the storage structure. The structure should be free from gas/oil pipe lines.

4.6 As far as possible, the godown shall not be near the place where molasses are stored or, where the press mud is discharged or, where the effluents of the factory are let out. These are the places of intense activity of micro-organisms and serve as sources of contamination and spoilage of sugar.

4.7 The railway siding may pass near or by the side of the godown for easy handling.

4.8 The general location of the godown is given in Fig. 1.

5 CAPACITY AND DIMENSIONS

5.1 The capacity of the sugar godown for storing sugar bags shall be roughly estimated at the rate of 50 kg per bag of sugar with a space volume of 0.08 m^3.

5.2 While estimating the height of stacks, care shall be taken to ensure that minimum space of about two metres is left between the top surface of the stack and the top of walls or the bottom of trusses employed

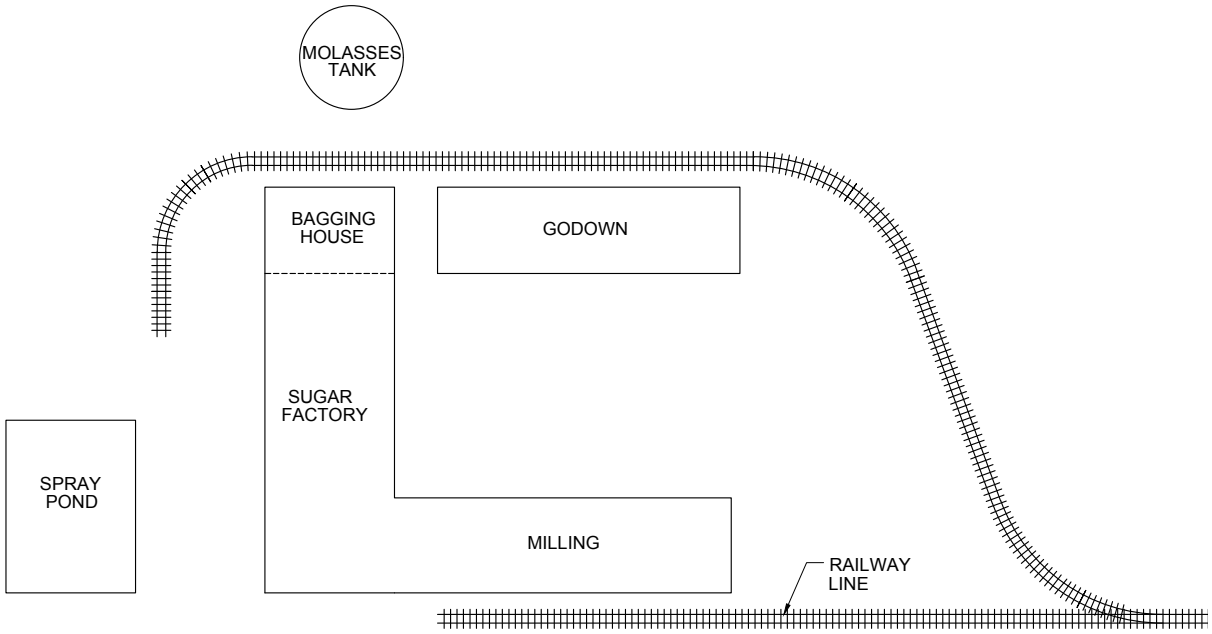


FIG. 1 GENERAL LOCATION OF A SUGAR GODOWN

for support of the roof. In case of portal frames, central portion is also utilized for stacking of bags. The height of the stack, however, depends upon the strength or load bearing capacity of HDPE/PP or jute bags used for storing sugar. For 'A' type of twill jute bags (*see* IS 1943), jute bags for packing 50 kg sugar (*see* IS 15138) or HDPE/PP of good quality bags (*see* IS 14869) the stack height may be as follows:

a) For plantation white sugar, stack height may be upto 52 bags for 50 kg bags; and

b) For refined sugar, stack height may be up to 26 bags due to caking problem during storage.

For mechanical bag handling using stackers and electrically operated belt conveyors stack height may be up to 50 bags or more. This stack height is recommended for stable trapezoidal pyramid type sections of stacks only.

5.3 The length and breadth of the godown usually depends upon the size of the ground area available for construction. It is desirable, however, for the purposes of symmetry that all godowns are of the same breadth and height in one factory. Table 1 gives the recommended capacities and dimensions of sugar godowns to store sugar bags. The capacities have been estimated for 50 kg plantation white sugar on the basis of stacks being 50 or more bags for stable trapezoidal pyramid type sections. It may be upto 60 m wide and 90 m long.

Table 1 Recommended Capacities and Dimensions for Sugar Godowns (Internal Dimensions)

(*Clause* 5.3)

Sl No.	Approximate, Capacity in 50 Kg Bags	Length	Breadth	Height
		m	m	m
(1)	(2)	(3)	(4)	(5)
(i)	50 000	40	20	10
(ii)	125 000	55	30	10
(iii)	150 000	65	30	10
(iv)	175 000	55	40	10
(v)	200 000	65	40	10
(vi)	250 000	60	50	10
(vii)	275 000	60	55	10
(viii)	375 000	110	40	10
(ix)	450 000	90	60	10

6 STACKING

6.1 According to the capacity of the godown, the floor area shall be marked into rectangular or square stack spaces. Care shall be taken that all alleyways of at least one meter width are left between the stack and walls and about 1.5 m in between the stacks. For the purpose of obtaining maximum capacity of the godown it is recommended that there should be one stack spreading lengthwise having one meter alleyway on all sides. For the sake, of convenience each stack shall contain sugar of the same quality or grade (*see* IS 498).

6.2 General plans for a typical sugar godown for stacking bagged sugar are suggested in Fig. 2.

6.3 The stack shall be so built that when completed, it is stable and perfectly cuboid in shape (*see* Fig. 3) and also that all peripheral bags on faces of the stack are in one plane or without any face of the stack bulging outward or inward at any point.

6.3.1 Sugar bags shall be stacked in a way so as to give the maximum strength to the stack. The stacking shall be done with one layer lengthwise and another breadthwise. In mechanized bag handling operation for more than 24 layers higher stacks pyramid section is recommended.

7 FOUNDATION

7.1 The foundation and column shall be designed as per IS 1080 suitable foundation depending upon the site conditions may be provided. The type of foundations will depend upon the property of the subsoil and the same may be provided according to relevant Indian Standard Codes.

7.2 The foundation shall, in no case, be less than one metre deep unless hard rock is met with at a depth less than one metre, subject to a minimum depth of footing not less than 75 cm. The foundation shall not be less than 120 cm deep under the cement concrete columns.

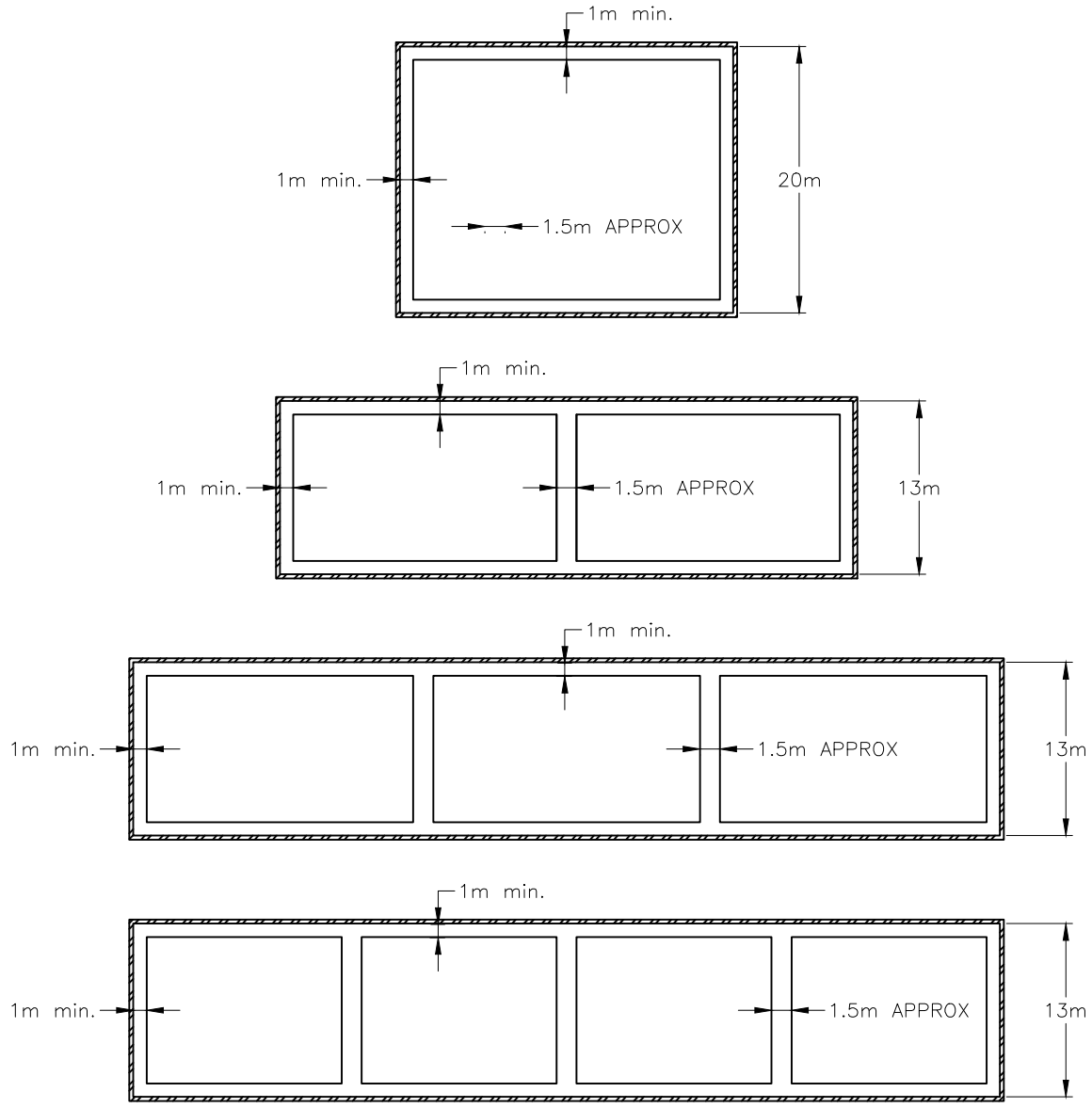


FIG. 2 RECOMMENDED STACKING ARRANGEMENTS FOR 13 AND 20 METRE SPANS

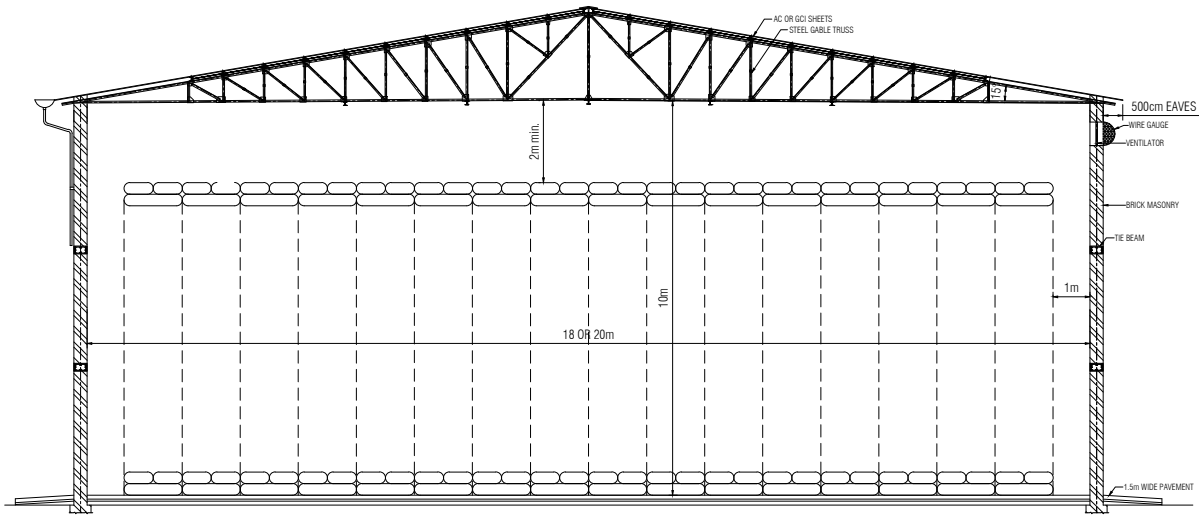


FIG. 3 SECTIONAL ELEVATION OF SUGAR GODOWN WITH SCHEMATIC STACKING (BASIS ONE STACK)

7.3 Wherever rock is met within the foundation depth, it shall be properly dressed, leveled and, if necessary, cut in horizontal steps so as to receive the footings of the foundation.

7.4 The foundation, in general, shall consist of the bed of cement concrete not leaner than the mix of 1 : 5 : 10 (1 cement : 5 coarse sand : 10 stone aggregate of 40 mm nominal size) for the walls and under the footing of the columns. The reinforced cement concrete columns shall be of mix not leaner than 1 : 1.5 : 3 (1 cement : 1.5 coarse sand : 3 stone aggregate 20 mm nominal size) for the nominal mix concrete and M 20 for the controlled concrete as per the requirement of design. The course of the lean concrete under the footings of the walls and RCC columns shall not be less than 15 cm and 7.5 cm respectively or otherwise as per the recommendation in the structural design 5.

7.5 The foundation shall be carried to hard soil and to a depth at which cracks in the soil do not exist and where the bearing capacity is adequate to withstand the intensity of foundation pressure. The bearing capacity of the soil shall be properly investigated.

7.6 The foundation on both the sides shall be refilled with selected earth suitable for filling and free from salt, organic or other foreign matter or with sand except the seashore sand or moorum which shall be compacted and made flush with the ground level.

8 PLINTH

8.1 It is desirable that the plinth level of the bagging houses is at the same height as that of the godown.

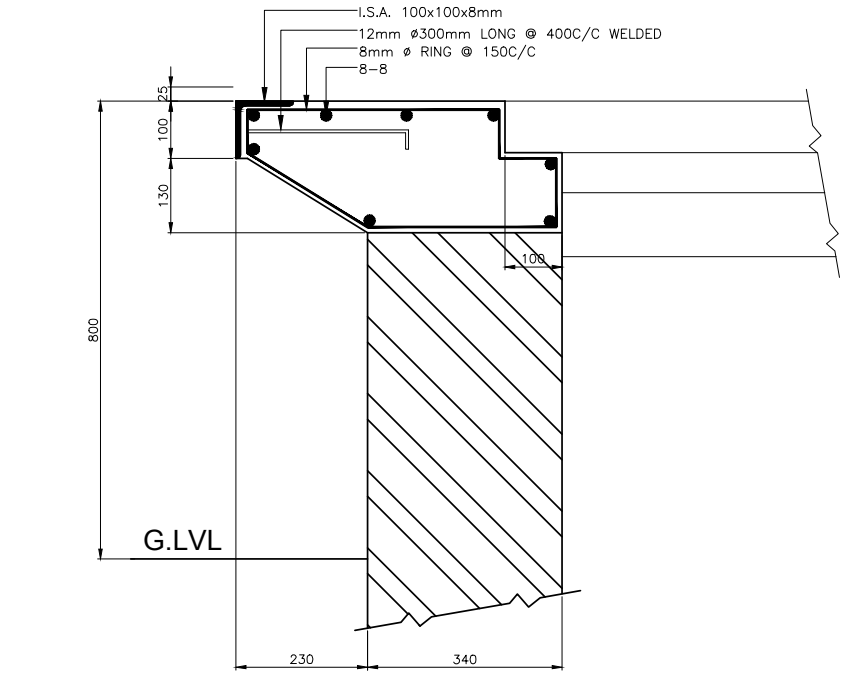
8.2 The plinth shall be generally kept 0.5 m or more above the ground level. The height of the plinth largely depends upon the subsoil water level. In the case of sub-mountainous and other low level areas the height of the plinth shall be at least one metre. The plinth height can be extended upto 90 cm to 120 cm for the road-fed godowns and the minimum width of platform for the road-fed structures shall be 183 cm.

8.3 In case a railway siding is to be provided by the side of the structure, the height of the plinth shall be such as to have the platforms at a height as per railway requirements. For the rail-fed structures, the plinth height shall be 106 cm above the top of the corresponding broad gauge track and width of platform shall be 3 m. To prevent rain water from getting inside the godown through doors, the platform shall be provided with a slope of 1 in 40 from the wall to its outer edge. In case of the road-fed structures, the platform plinth level of the structure should be fixed taking the highest flood level into account, and it should be at least 500 mm above the highest flood level. The general arrangement of platform plinth with coping details and other particulars is shown in Fig. 3A.

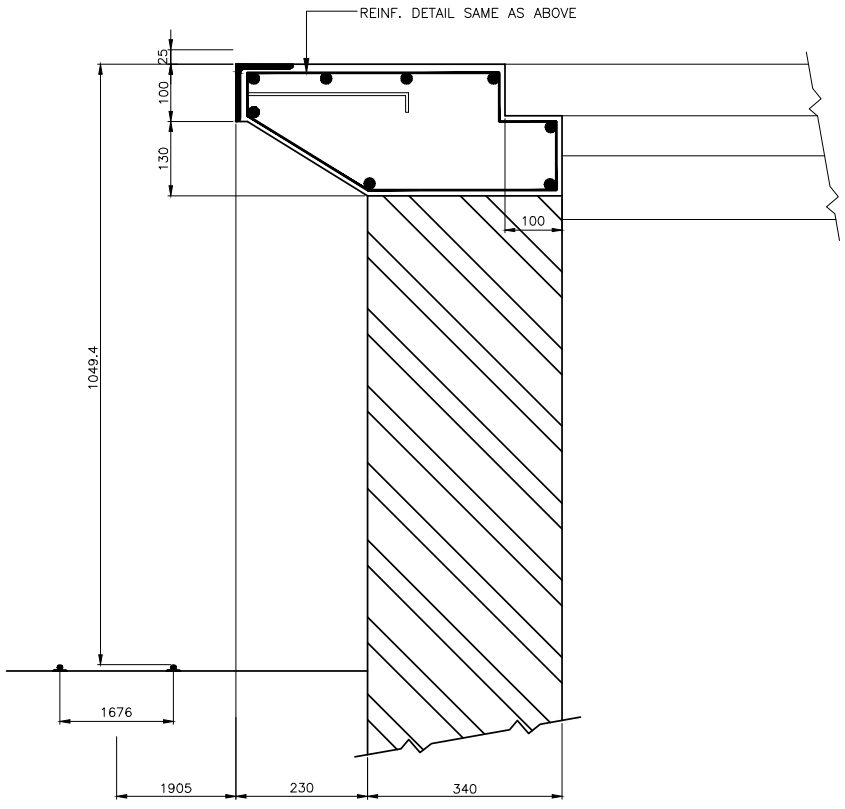
8.3.1 Where platforms are provided, they shall be preferably covered.

8.4 Plinth Filling and Laying of Floor

8.4.1 The principal aim of the plinth is to prevent the creepage of moisture from subsoil water. Investigations show that lime mortar is more helpful in lessening



RCC NOSING FOR ROAD SIDE PLATFORM



All Dimensions in Millimeters

FIG. 3A DETAILS OF RCC NOSING RAIL AND ROADSIDE PLATFORMS

the creepage of moisture than the cement mortar. The plinth shall be filled with selected earth depending upon the availability, excluding black cotton soils and other unsuitable soils, in layers not exceeding 200 mm with each layer being watered, well rammed and consolidated. When filling reaches the finished level, the surface shall be flooded with water for at least 24 h, allowed to dry and then rammed and consolidated in order in order to avoid any settlement at a later stage. The finished level of filling shall be kept in slope intended to be given on the floor. These layers shall be taken up to the formation level for the earth filling

8.4.2 The plinth shall be constructed of either stone or brick masonry in cement mortar 1:6 (1 cement : 6 coarse sand) including gable walls. It shall be provided with damp proof course of well graded concrete with waterproofing compound (*see* IS 2645) to a minimum thickness of 40 mm on brick masonry and 50 mm on stone masonry. The first course of the plinth shall be of 75 mm rammed earth with interstices filled with lean cement concrete. Over this concrete, damp-proof treatment shall be provided. The preparatory work for the damp-proofing treatment shall be in accordance with provision as per IS 3067. The damp-proofing treatment shall be laid using bitumen felt as laid down in IS 1609.

NOTE — These are the usual specifications adopted for such structures. The actual specifications shall be based on proper designs and stresses developed depending upon the strength of raw material and mortar used. In seismic areas suitable precautions may be observed in the construction of building which should be according to IS 1893 and IS 4326.

8.5 Plinth Protection

The structure shall be provided with plinth protection of at least 900 mm width excluding platform portion around the structure and shall have minimum outward slope of 1 in 48 for satisfactory drainage of rain water. The plinth protection shall not be required on the side where rail side platform is provided. The plinth protection may consist of a layer of 115 mm thick brick or stone ballast, consolidated dry to the required slope, the surface shall be grouted evenly with fine sand 0.06 m^3 /10 m^2 and slightly sprinkled with water and rammed. A topping of 50 mm thick cement concrete (1:3: 6) may be laid in alternate panel slabs over a well-rammed brick or stone ballast and finished smooth at top. The finished surface may have a minimum outward slope of 1 in 48. Any other mode of the plinth protection may be adopted depending upon the site condition and economy of the materials for a particular locality. If vehicular traffic is likely to come on the plinth protection, the same should be suitably designed as a pavement in such portions.

8.5.1 It may be ensured that wherever plinth protection is laid on filled up earth; such filling shall be with selected earth properly consolidated. Black cotton soil shall not be used in such filling.

9 FLOOR

9.1 The floor shall be cement-concrete (*see* IS 2571) or brick flooring (*see* IS 5766).

NOTE — Brick flooring is preferable to cement concrete flooring. The flooring in the storage structure should be damp proof, rigid, durable and free from any cracks or crevices.

9.1.1 The following types of flooring may be provided for in the structure (Fig. 4):

a) Selected earth filling well consolidated and stabilized to avoid possibility of settlement and cracks.

b) A layer of sand filling 230 mm thick thoroughly watered and well consolidated.

c) A layer of cement concrete (1: 5: 10) 150 mm thick.

d) A top wearing coat of 50 mm thick cement concrete (1 : 2 : 4) finished with a floating coat of neat cement shall be provided. The cement concrete flooring shall be laid in panels not exceeding 3.5 m^2 in area and 2.5 m and above in any direction. Such panels shall be suitably adjusted so as to avoid transfer of any uneven load at the joints under the stacking bays and alleyways. The panels shown in Fig. 5 may be suitably adopted.

NOTES

1 In area which may have water logging, a layer of bitumen-felts 80/100 *Max* or equivalent spread uniformly at the rate of 1.7 kg/m^2 may be provided in between the layer of cement concrete (1 : 5 : 10) as referred to in **9.1.1** (c).

2 In case, polythene sheet is used in place of bitumen- felts, a layer of 700-gauze polythene sheet sandwiched in between the sand layers as referred to in **9.1.1** (b) shall be laid with necessary overlap of 150 mm at joints; joints hot sealed and ends properly anchored in suitable grooves left in walls for water tightness.

9.1.2 Alternatively the flooring and the course of the water bound macadam (WBM) underneath the cement concrete flooring (Fig. 4A) should be provided as under:

a) Selected earth in the filling well compacted and stabilized for avoiding possibility of any future settlement and cracks etc.

b) 150 mm thick WBM with stone aggregate of size 63 - 45 mm (grade II) with corresponding screening and binding material.

c) 75 mm thick WBM to be laid with 53 - 22.4 mm sized stone aggregate (Grade III) with corresponding screening and binding material.

d.) 50 mm thick cement concrete flooring in the cement concrete mix of 1:2:4 finished with a floating coat of cement.

9.1.3 Paneling in the cement concrete flooring shall be provided with glass strip having thickness 4 mm and depth as per the thickness of the floor.

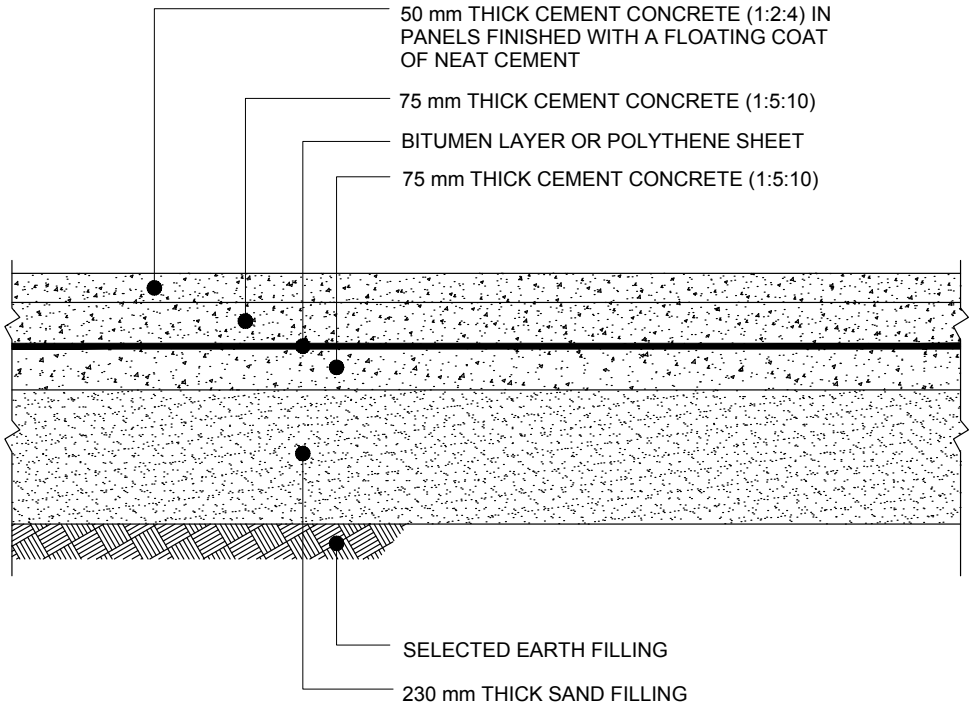
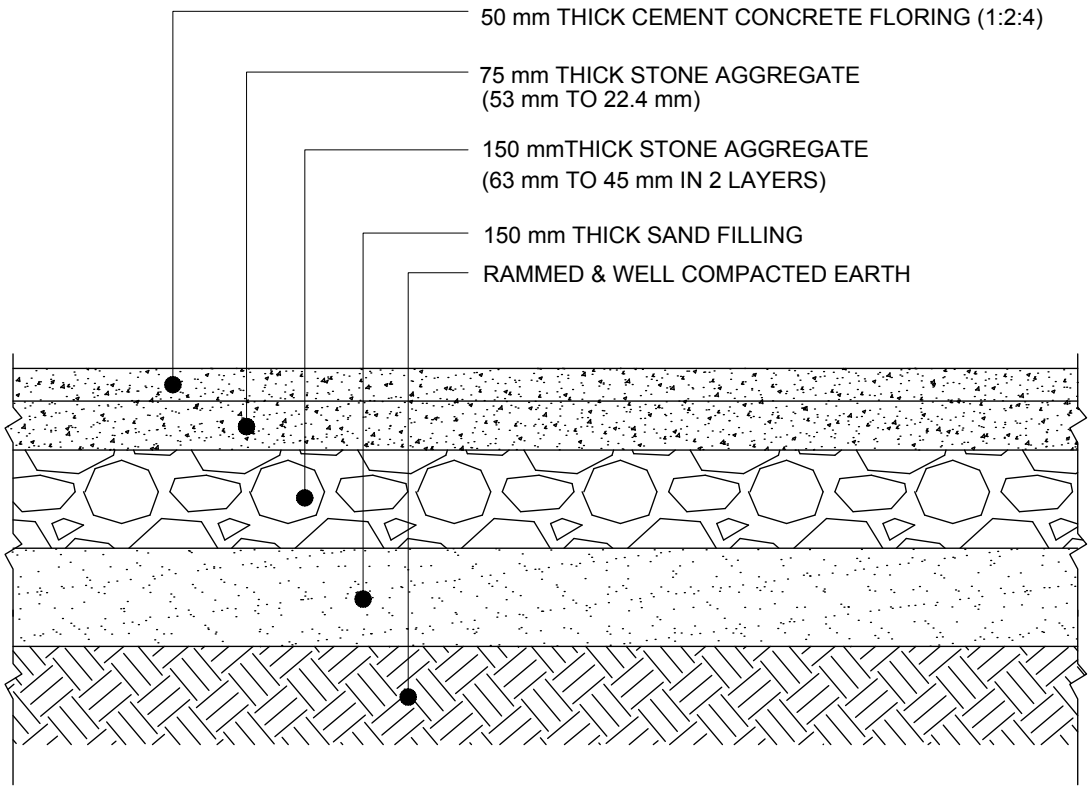


FIG. 4 DETAILS OF FLOORING (MAIN GODOWN)



All Dimensions in Millimeters

FIG. 4A ALTERNATE DETAILS OF FLOORING

10 STRUCTURE

10.1 The godown shall be constructed as a framed structure consisting of reinforced cement-concrete columns and tie beams. The structure shall be designed in accordance with the provision given in IS 456.

10.2 The design of the walls shall be in accordance with the general constructional practices (*see* IS 1905) and care shall be taken that the tensile stresses do not exceed the cracking limit. The following type of walls may be provided for the storage structure. The walls shall be built of either stone masonry (*see* IS 1597 (Part 1) or bricks masonry (*see* IS 2212) and shall be designed in accordance with the provision of IS 1905. The thickness of the wall shall be 350 mm minimum. The joints between the columns and walls shall be properly sealed by grouting. The columns and wall shall be rendered smooth by plastering with lime mortar or cement mortar in accordance with the provision laid down in IS 2394 or IS 1661. The walls may also be pointed where hollow blocks (*see* IS 3952) are used, they shall be cement plastered on both sides.

10.3 The longitudinal walls shall be of brick or stone masonry in cement mortar 1 : 6 (1 cement: 6 coarse sand) and shall be at least 5 600 mm high for road-fed as well as rail-fed structures from the plinth level. They shall be at least 230 mm in thickness. Wherever there is non availability of bricks/stone for masonry work, alternatively CC hollow blocks of suitable size of mix 1 : 3 : 6 should be used. RCC columns should be provided to support the trusses connected with the beams at the top level and one more beam of RCC in the concrete mix 1 : 1.5 : 3 should be provided at the door level in the areas falling under seismic zone IV and V. The gable wall and the partition wall should be provided with the same type of masonry being provided in the longitudinal walls in the cement mortar of same ratio/mix and shall be at least 340 mm in thickness. The walls shall be flush with the inner surface of the column and shall be plastered in cement mortar 1 : 6 (1 cement: 6 fine sand). They shall be rendered smooth both on the outer and the inner surfaces. There shall be no offsets or projections in the wall. The inside edges of the wall where they meet the floor, all corner shall be rounded off to a radius of at least 50 mm. Spacing of the RCC columns is recommending ideally as 4650 mm from centre to centre which may also be altered as per the requirement /design / dimension of the site/plot for optimum utilization. In seismic areas, structural engineer should be consulted for giving the earthquake resistant designs of the structure and criteria for earthquake resistant designs of structures as per IS 1893 and for earthquake resistant construction as per IS 4326 shall be followed.

NOTE — Where modular bricks are used according to IS 1077, thickness of the walls may be kept as 300 mm (nominal) for the longitudinal and intermediate partition walls and 400 mm (nominal) for the gable walls.

11 RESISTANCE TO EARTHQUAKE

The godown shall be designed and constructed to take care of earthquake forces in accordance with the provision given in IS 1893 and IS 4326.

12 ANTI-TERMITE MEASURES

Anti-termite measures may be adopted in accordance with IS 6313 (Part 1) and IS 6313 (Part 2).

13 DOORS

13.1 Ordinarily two doors shall be provided for each sugar godown. The doors shall be fitted with steel rolling shutters (*see* IS 6248) on the outside and a sliding door on the inside (*see* Fig. 5).

13.2 Doors shall be of dimensions 3.7 × 3 m.

13.3 Doors' shall have *CHHAJJA* of at least 1.2 × 5 m dimensions (*see* Fig. 5). A door shall be provided preferably opposite each gangway. The doors shall be of rolling shutters and fixed into suitable prepared openings. The doors shall be not less than 1830 × 2450 mm. Regular and periodical inspections and maintenance of the rolling shutters should be carried out to avoid defects and damages. Alternatively the garage door as per the details shown in Fig. 6A may also be used in view of its less maintenance and especially in the remote areas.

13.4 An antechamber of dimensions 4.5 × 3.6 m shall be provided on the outside of the godown door to break the direct blast of air. Details are given in Fig. 7.

14 ROOF

14.1 The roofing material such as light coloured polyester pre-coated sheets and corrugated GI sheets (*see* IS 277), steel sheets or, corrugated aluminium sheets or, black corrugated sheet, not thinner than 0.56 mm may be laid over steel gable truss or prefabricated portal frames. Use of corrugated asbestos cement sheets may be avoided (*see* Fig. 8). The truss, shall be designed in accordance with, the provision given in IS 875 and IS 800. The corrugated sheets shall be laid in accordance with the provision of IS 3007 (Part 1).

14.2 Galvanized Corrugated Sheet (GCI)

The sheets shall project at least 0.75 m from the longitudinal walls. (where there is recurrence of heavy hailstorms, the use of corrugated asbestos cement sheets may be avoided). The sheets shall overlap longitudinally at least by one and half corrugations. Asphalt impregnated hessian cloth of at least 10 cm width is interposed in the overlapping of sheets. The purlins and sheets shall be well anchored and secured on the purlins by means of galvanized iron J or L hooks sufficiently long to have good grip over sheets and

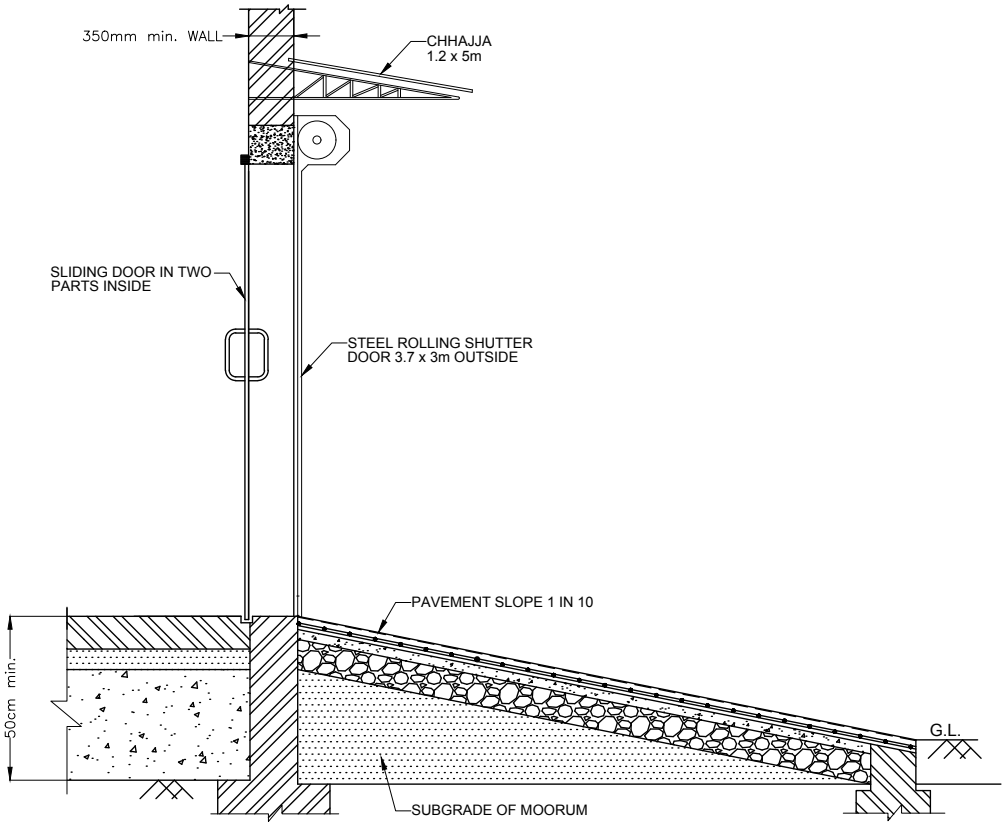


FIG. 5 DETAILS OF DOOR OF SUGAR GODOWN

purlins and accommodate nuts and washers. Bituminous washers shall be used for securing the sheets. In areas liable to excessive heat, use of heat reflecting paint on the top may be considered. Damp-proofing with bitumen felt, other latest and modified materials such as APP (Acactic Polypropylene Polymeric), modified polymeric membrane and glass fiber bitumen felts as per IS 7193 shall be carried out on the entire roof of the sugar godown (*see* IS 1346).

14.2.1 Purlins may be of structural steel rolled or tubular sections. The spacing of purlins shall be as given in IS 3307 (Part 1).

14.2.2 The design of the purlins shall be in accordance with the general constructional and Indian Standard design practices.

14.2.3 Suitable arrangement shall be provided for expansion of purlins and bottom runners. They may be provided preferably at the partition and gable walls.

14.2.4 The trusses need not be provided on the gable and partition walls. The purlins may, however, rest and be deeply anchored on the gable and the partition walls.

14.2.5 Wind ties of MS flat of size 40 × 6 mm may be provided in a minimum of 4 rows in the godown structure and one row on the platform roofing.

14.2.6 Transparent/translucent sheets of about 2 percent of the total area of the roof and evenly distributed may be provided for natural light.

14.2.7 Polyester coated pre-painted sheets may also be considered in the roofing.

14.3 Gable and Partition Walls

A beam may be provided at the tie level of truss over gable and partition walls. Where gabled roof is constructed, care should be taken that no hollow space is left between the walls and the roof covering**.**

15 DRAINAGE

15.1 The general requirement for the drainage of sugar godown shall be in accordance with

IS 1742. Rain-water pipes shall be provided at every alternate bay for drainage of rain-water from the roof (*see* IS 2527). A rain-water gutter made of G I sheet or asbestos cement pipe of adequate size shall be fixed to the roof as shown in Fig. 3. The gutter shall open into the rain-water pipes of cast iron or cement and of adequate size. The pipes shall be properly secured at the off take and also securely fixed with clamps to the wall at every 2 m. The lower ends of the drain pipes .shall be 15 cm above the ground level and shall be

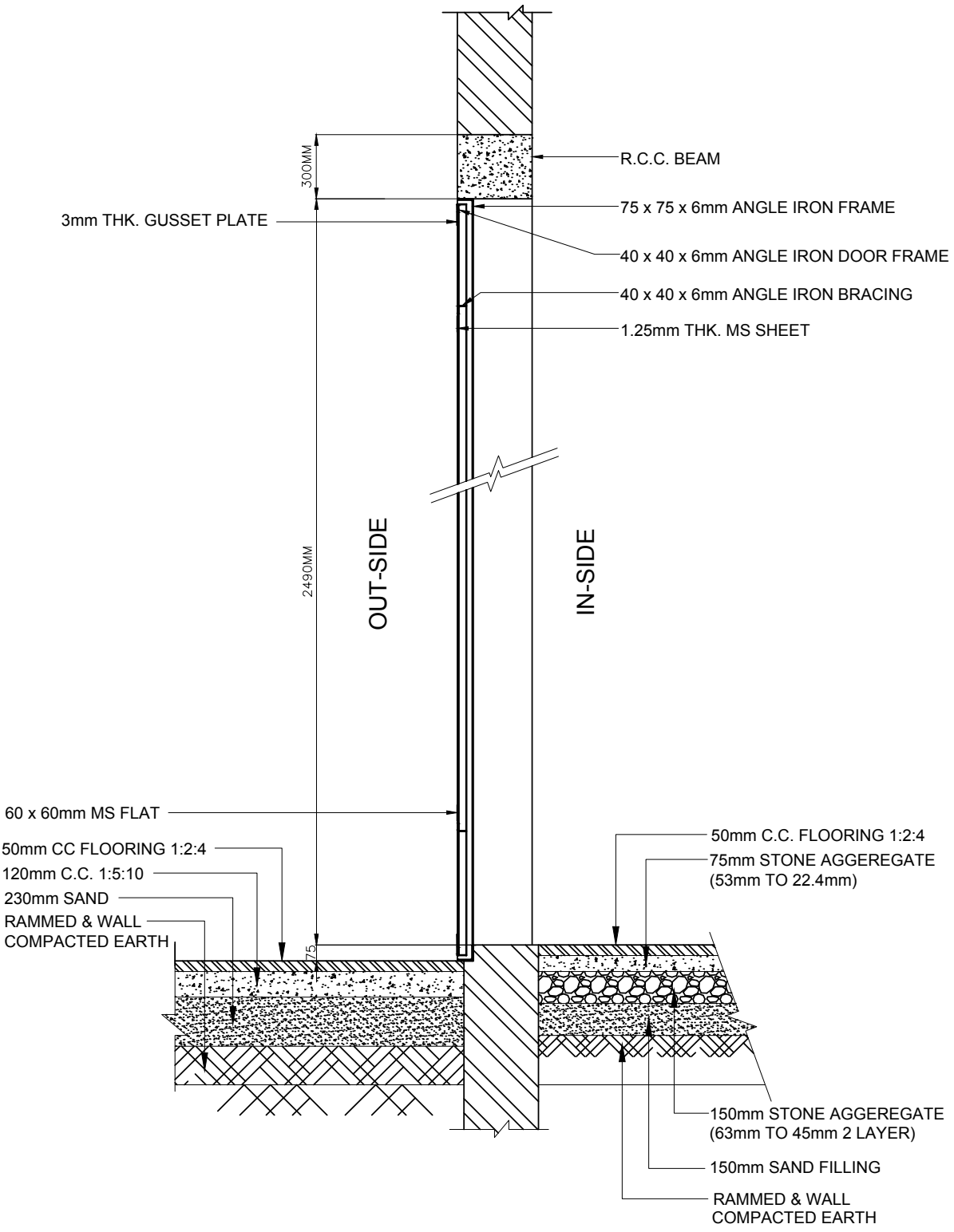
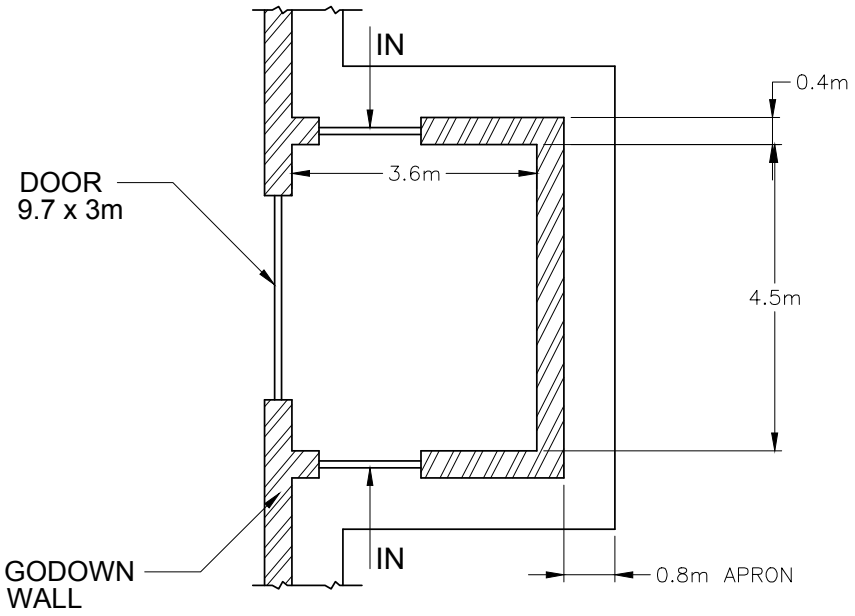


FIG. 6A DETAILS OF STEEL DOOR



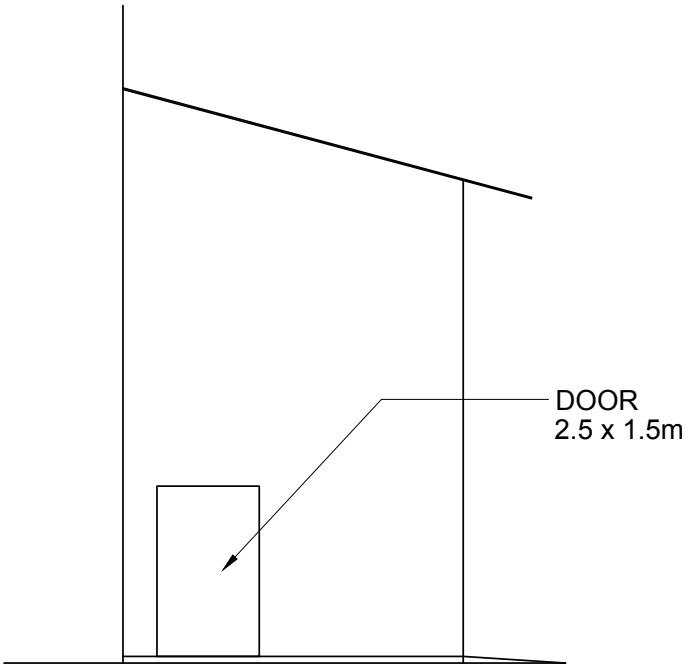
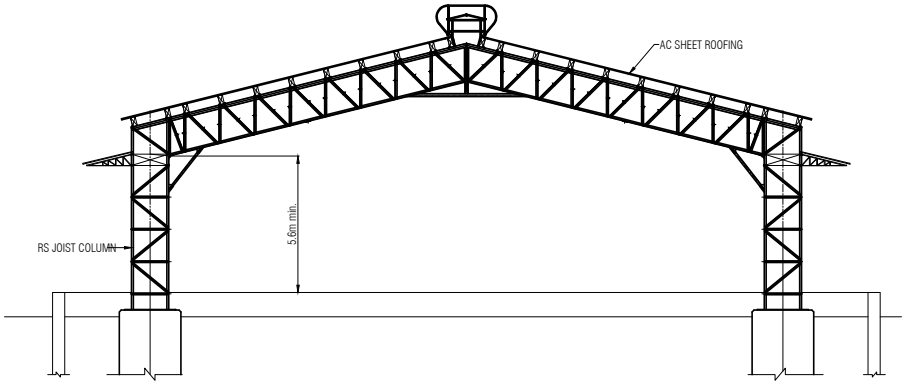
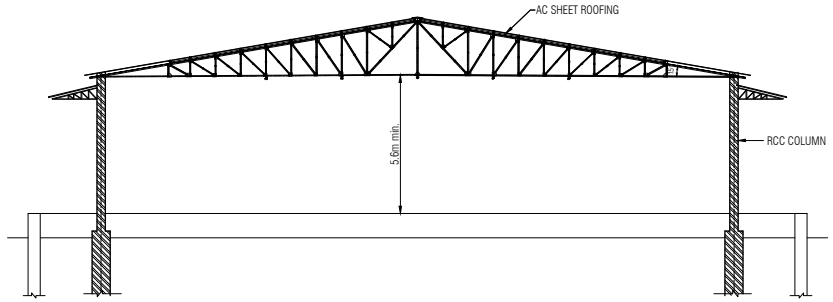


FIG. 7 DETAILS OF AN ANTECHAMBER



STEEL FRAME TRUSSES (SPAN 21.8m C/C) GABLE ROOF



CONVENTIONAL STRUCTURALSTEEL
OR TUBULAR FRAME TRUSSES (SPAN 21.8m C/C)

FIG. 8 DIFFERENT TYPES OF ROOFS FOR SUGAR GODOWNS

provided with shoes (*see* Fig. 9). The rain-water shall be drained off by suitable open drains 1.5 m away from the main structures.

15.2 Rain Water Pipes

On rail side platform rain-water pipes shall be provided at each bay for drainage of rain water from the roof. The rain-water eaves gutter at the outer end of the platform truss of adequate section to receive the rain water both from the main structure roof and platform roof shall be provided and suitably connected to the down-take rain water pipes. They shall be of cast iron, asbestos cement pipes (*see* IS 1626), polyvinyl chloride (PVC) or soil waste and rain (SWR) pipes of diameter not less than 110 mm. Their diameter shall also be adequate depending on the intensity of the rainfall of the place. The pipes shall be properly secured at the off take and also securely fixed with clamps to the RCC columns or walls at every 1.8 m. The rain water shall be drained off by suitable open drains fairly away from the main structure. Where rail side platforms are provided, the drain pipes shall be connected to the suitable manholes provided under platform and rain water shall be drained off by asbestos cement pipes, PVC or SWR pipes of adequate diameter connecting the manholes. The manholes shall be provided with heavy-duty covers. On the road-side platforms, a strip of 90 cm brick paving may be provided along the platform walls to protect the scouring of the road surface from the rain water falling from the roof directly. A suitable saucer drain of 300 mm diameter may also be provided by the side of platform wall to drain away the rain water of the roof. Surface area drain to carry run off may also be provided for disposal of water of the complex.

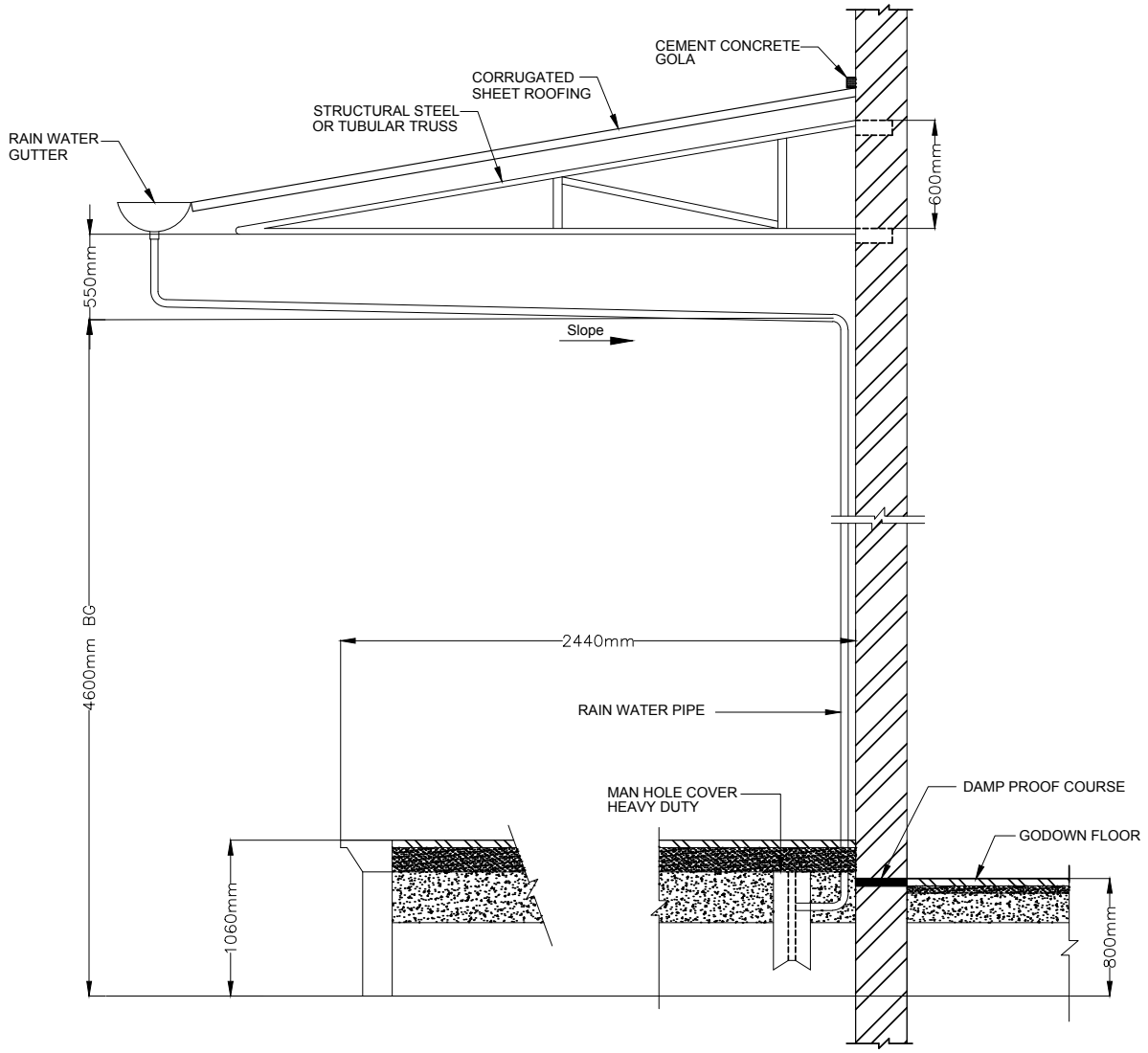


FIG. 9 DETAILS OF EAVES GUTTER

16 PAVEMENT

All around the structure, abutting the plinth, a pavement 1.5 m wide and about 17 cm thick shall be provided (*see* Fig. 3). The slope of the pavement shall be 1 in 10. It shall consist of a bed of brick or stone aggregate well consolidated to a thickness of 9 cm over a sub-grade of *MOORUM* and finished with 7.5 cm thick cement concrete (1 : 3 : 6).

17 FINISHING

17.1 The internal faces of the walls of the structure shall be cement plastered and external faces up to floor level shall be smooth plastered. The internal faces may be whitewashed and external faces provided with colour wash.

17.1.1 All the steelwork and woodwork shall be provided with two coats of superior quality paint over a coat of primer.

17.1.2 The galvanized iron or aluminum sheets shall be painted with two coats of superior quality paint suitable for GI or aluminum sheets over a coat of primer suitable for such surfaces. Black corrugated sheets where used shall also be painted with suitable paints which prevent rusting and deterioration of these sheets in addition to the priming and finishing coats.

17.1.3 The paint to be used inside the godown for steelwork and steel/aluminium sheets shall resist the adverse effects of fumigants.

17.1.4 In the coastal area, choice of the paint on the steel items/structure should be according to the environmental conditions so as to combat the effect of rusting etc.

17.1.5 In the heavy rainfall areas, external surface of walls should be finished with cement water proofing paint.

18 ELECTRIC WIRING AND LIGHTING

18.1 Electric wiring installations shall conform to IS 732. All wiring shall be of recessed metallic conduit type and only PVC cables conforming to IS 694 shall be used. No socket outlets shall be provided inside the godown.

18.2 The illumination level within the godown shall be not less than 100 lux; only bulkhead type lighting fittings shall be used in the godown and they shall be installed along the wall. All lights within the godown shall be controlled only by a double pole switch. This shall be installed at the outside of the main door so as to cut off the electric supply when the godown door is closed.

18.3 All light fittings shall be of 'Protected type' (in which the lamp is enclosed by heat resisting toughened clean glass) and the same shall be mounted from the wall and not hung from the roof truss.

18.4 All the joints shall be made, in proper joint boxes provided with the light fittings as given in **16.3.**

18.5 Arrangements should 'be provided for proper earthing of all electrical fittings'. All electrical equipment at medium voltage shall be earthed by two separate and distinct connections with earth.

19 FIRE FIGHTING ARRANGEMENTS

19.1 The provision of fire extinguisher CO, type (*see* IS 2878) shall be made. The scale and fixing of extinguisher shall be as per IS 2190. The electrical installations inside and outside the godown shall be fixed to provide safety against fire in accordance with the provision given in IS 1646.

19.2 It is also advisable to make arrangements for an automatic fire alarm system as per IS 2189.

ANNEX A

(*Clause* 2)

IS No.	*Title*
277 : 2018	Galvanized steel sheets (plain and corrugated) — Specification (*seventh revision*)
456 : 2000	Plain and reinforced concrete — Code of practice (*fourth revision*)
459 : 1992	Corrugated and semi-corrugated asbestos cement sheets — Specification (*third revision*)
498 : 2003	Grading for vacuum pan (plantation white) sugar (*fifth revision*)
694 : 2010	Polyvinyl chloride insulated unsheathed and sheathed cables/cords with rigid and flexible conductor for rated voltages up to and including 450/750 V (*fourth revision)*
732 : 1989	Code of practice for electrical wiring installations (*third revision*)
800 : 2007	General construction in steel — Code of practice (*third revision*)
806 : 1968	Code of practice for use of steel tubes in general building construction (*first revision*)
875 (Part 1) : 1987	Code of practice for design loads (other than earthquake) for buildings and structures: Part 1 Dead loads — Unit weights of building material and stored materials (*second revision*)
875 (Part 2) : 1987	Code of practice for design loads (other than earthquake) for buildings and structures: Part 2 Imposed loads (*second revision*)
875 (Part 3) : 2015	Design loads (other than earthquake) for buildings and structures — Code of practice: Part 3 Wind loads (*third revision*)
875 (Part 4) : 1987	Code of practice for design loads (other than earthquake) for buildings and structures: Part 4 Snow loads (*second revision*)
875 (Part 5) : 1987	Code of practice for design loads (other than earthquake) for buildings and structures: Part 5 Special loads and load combinations (*second revision*)
1077 : 1992	Common burnt-clay building bricks — Specification (*fifth revision*)
1080 : 1985	Code of practice for design and construction of simple spread foundations (*second revision*)
1161 : 2014	Steel tubes for structural purposes — Specification (*fifth revision*)
1239 (Part 1) : 2004	Steel tubes, tubulars and other wrought steel fittings — Specification: Part 1 Steel tubes (*sixth revision*)
1346 : 1991	Code of practice for water proofing of roofs with bitumen felts (*third revision)*
1597 (Part 1) : 1992	Code of practice for construction of stone masonry: Part 1 Rubble stone masonry (*first revision*)
1609 : 1991	Damp- proof treatment using bitumen-felts — code of practice (*third revision*)
1646 : 2015	Fire safety of buildings (general): Electrical installations — Code of practice for (*third revision*)
1661 : 1972	Code of practice for application of cement and cement-lime plaster finishes (*first revision*)
1742 : 1983	Code of practice for building drainage (*second revision*)
1893 : 1984	Criteria for earthquake resistant design of structures (*fourth revision*)
1905 : 1987	Code of practice for structural safety of buildings: Masonry walls (*third revision*)
1943 : 1995	Specification for A-twill jute bags (*second revision*)
2189 : 2008	Code of practice for selection, installation and maintenance of automatic fire detection and alarm system (*fourth revision*)

IS No.	*Title*
2190 : 2010	Selection, installation and maintenance of portable first-aid fire extinguishers — Code of practice (*fourth revision*)
2212 : 1991	Code of practice for brickwork (*first revision*)
2394 : 1984	Code of practice for application of lime plaster finish (*first revision*)
2527 : 1984	Code of practice for fixing rain-water gutters and down pipes for roof drainage
2541 : 1991	Code of practice for preparation and use of lime concrete (*second revision*)
2571 : 1970	Code of practice for laying in-situ cement concrete flooring (*first revision*)
2878 : 2004	Specification for portable and trolley mounted fire extinguishers, carbon-dioxide type (*third revision*)
3007 (Part1) : 1999	Laying of asbestos cement sheets — Code of practice: Part 1 Corrugated Sheets (*first revision*)
3067 : 2013	Code of practice for general design, details and preparatory work for damp-proofing and water proofing of buildings (*first revision*)
3952 : 2013	Specification for burnt clay hollow blocks for walls and partitions (*third revision)*
4326 : 2013	Code of practice for earthquake resistant construction of building (*third revision*)
5766 : 1970	Code of practice for laying burnt clay brick flooring
6313 (Part 1) : 1981	Code of practice for anti-termite measures in buildings: Part 1 Constructional measures (*first revision)*.
6313 (Part 2) : 2013	Code of practice for anti-termite measures in buildings: Part 2 Pre-constructional chemical treatment measures (*third revision*)
6248 : 1979	Specification for metal rolling shutters and rolling grills *(first revision)*
14968 : 2015	Textiles — High density polyethylene (HDPE)/Polypropylene (PP) woven sacks for packaging 50 kg/25 kg Sugar — Specification (*first revision*)
15138 : 2010	Textiles — Jute bags for packing 50 kg sugar — Specification (*first revision*)

ANNEX B

(*Foreword*)

COMMITTEE COMPOSITION

Sugar Industry Sectional Committee, FAD 02

Organization	*Representative(s)*
National Sugar Insititure, Kanpur	Shri Narendra Mohan (***Chairman***) Shri Ashutosh Bajpai (*Alternate*)
Army Service Core (ASC), New Delhi	Lt Col B. B. Sahu
CONCERT, Chennai	Shri R. Santhanam Shri M. Somasundaram (*Alternate*)
Consumer Guidance Society of India, Mumbai	Shri Sitaram Dixit Dr M. S. Kamat (*Alternate*)
Food Corporation of India, New Delhi	Shri Deepak Kumar Panwar Shri Rakesh Kumar Ranjan (*Alternate*)
Food Safety Standards Authority of India, New Delhi	Ms Apoorva Srivastava (Technical Officer)
Global Cane Sugar Ltd, New Delhi	Dr G. S. C. Rao Mr Anil Srivastava (*Alternate*)
Indian Institute of Sugarcane Research, Lucknow	Dr A. D. Pathak Dr A. K. Sharma (*Alternate*)
Indian Institute of Toxicology Research, Lucknow	Dr Yogeshwer Shukla
Indian Sugar Mills Association , New Delhi	Shri G. K. Thakur Shri Pankaj Rastogi (*Alternate*)
Indian Sugar Exim Corporation, New Delhi	Mr Rajiv Aggarwal Mr Rajeev Kurup (*Alternate*)
Ministry of Consumer Affairs, Food & Public Distribution, New Delhi	Shri Suresh Chandra
National Co-operative Development Corporation, New Delhi	Shri K. P. Vaish Shri N. K. Sharda (*Alternate*)
National Fed. Of Co-operative Development Corporation, New Delhi	Mr Manohar Gopal Joshi
The Sugar Technologists Association of India, New Delhi	Shri Sanjay Awasthi Shri Anurag Goyal (*Alternate*)
Triveni Engineering & Industries Ltd, Muzaffarnagar, UP	Shri Rajesh Singh Shri P. K. Khadelwal (*Alternate*)
BIS Directorate General	Shri P. Rajesh , Scientist 'E' and Head (FAD) [Representing Director General (*Ex-officio*)]

Member Secretary

Shri Rajpal
Scientist 'C', BIS

(*Continued from second cover*)

During rainy season, the humidity in atmosphere outside the godown is above 85 percent. Through leaks in doors, ventilators, roof, etc, the humid air enters the godown and increases the relative humidity therein. To arrest this, various suggestions have been made in this standard. The ingress of moisture from subsoil water into the godown through the floor and walls of the godown by capillary action is another very important factor in increasing the humidity inside the godown to cause deterioration of sugar. Such ingress of moisture is appreciable in sub mountainous (*TARAI*) and low level areas, particularly in the rainy season when subsoil water level goes up. The humid-proof floor and walls are, therefore, essential requisites for a sugar godown.

The composition of the Committee responsible for the formulation of this standard is given at Annex B.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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